

MEMS development for Space Applications at NASA/JPL

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Abstract

The MEMS Technology Group at JPL pursues the development of a wide range of technologies that are primarily applicable to NASA needs in the area of robotic planetary exploration. MEMS technologies are uniquely suited for space applications since they offer the advantages of low mass, low power consumption and reliability, without significant loss of capability. These attributes will not only enable the micro-spacecraft of the future but also provide low-mass devices with high redundancy for conventional spacecraft. The MEMS-based technologies being developed include Micro-Gyroscope devices, Micro-Propulsion (Solid, Liquid and Gaseous propellant) devices, Micro-Valves, LIGA-based micro-devices, sensors and devices for System-on-a-chip applications and Micro-Instruments. End-to-end prototype development of these technologies is conducted at the Microdevices Laboratory, a 38,000 sq. ft. facility with over 5000 sq. ft of cleanrooms (class 10 – 100,000) and over 5000 sq. ft. of characterization laboratory space. The facilities include computer design and simulation tools, optical and electron-beam lithography, dry and wet etching facilities including deep reactive ion etching, metallization, assembly and device testing facilities. Following the fabrication and assembly of the device prototypes, reliability testing of these devices is conducted to determine failure modes. The need for low-cost, rapid space testing of these prototypes and a possible solution via the use of “PICO-Sats” will also be discussed.